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Supplementary Notes

Abstract

The objective of this research was to investigate methods of computing average life values for carpoolers and vanpools in Virginia. These statistics are to be used by the Rail and Public Transportation Division in evaluating the efficiency and cost-effectiveness of the ridesharing programs it funds. Achievement of this objective required a means of determining what data were needed, how best to collect them,and equations to calculate the average life values. In addition, the division wanted a means of developing average fuel economy statistics for commuter vehicles used in this state. A literature search was undertaken, and several alternative methods of collecting and computing these data were explored. The theoretical basis of this study was derived from efforts by the consulting firm of Crain and Associates to develop similar statistics for the city of Los Angeles, California. The Virginia study followed their general approach to the problem, but varied significantly in the proposed method of data collection and computation of the statistics.

From the information developed, it is recommended that the Department (1) perform a multi-year survey of both carpoolers and vanpool drivers to collect pool participation data, (2) use these data to determine the average number of years an individual remains in a carpool and the average longevity of a vanpool, and (3) annually survey ridesharers to collect miles-per-gallon data from which a statewide average commuter vehicle MPG can be developed.

VIRGINIA RIDESHARING STATISTICS:

Methodologies for Determining Carpooler and Vanpool Average Life Bases and the Average Fuel Economy of Commuter Vehicles

by

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Virginia Highway & Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways & Transportation and the University of Virginia)

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ABSTRACT

The objective of this research was to investigate methods of computing average life values for carpoolers and vanpools in Virginia. These statistics are to be used by the Rail and Public Transportation Division in evaluating the efficiency and cost-effectiveness of the ridesharing programs it funds. Achievement of this objective required a means of determining what data were needed, how best to collect them, and equations to calculate the average life values. In addition, the division wanted a means of developing average fuel economy statistics for commuter vehicles used in this state. A literature search was undertaken, and several alternative methods of collecting and computing these data were explored.

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PURPOSE AND BACKGROUND

The purpose of this report is to recommend to the Rail and Public Transportation Division (RPTD) of the Virginia Department of Highways and Transportation (VDH&T) a means of generating certain ridesharing statistics. These statistics are to be used in the benefit/cost calculations prepared by the RPTD as part of its annual evaluation of the cost efficiency and effectiveness of state funded ridesharing programs, as well as by local ridesharing agencies (RSAs) for comparable assessments of their individual programs.

The need for these annual evaluations stems from a decision by the RPTD to implement an evaluation process to improve the performance of the 15 local ridesharing programs the Department funds. In addition, the Joint Legislative Audit and Review Committee (JLARC) has recommended that the Department institute uniform financial and operating report formats to analyze the efficiency of programs it administers, thus further encouraging the development of an evaluation process.

The RPTD contracted with the consulting firm of JHK and Associates to develop these evaluative mechanisms. The consultant recommended a process based substantially upon one developed for the Federal Highway Administration (FHWA) by the firm of Crain and Associates of California. Part of this evaluation package consists of a survey of individuals who have applied to local RSAs to obtain carpool match lists. The survey determines how many people join a carpool or vanpool and the reductions in fuel consumption, pollutants emitted, vehicle miles of travel, and costs that are being experienced.

The end result of this evaluation is a series of benefit/cost calculations comparing commuter savings, number of applicants placed in ridesharing arrangements, and the numbers of carpoolers and vanpoolers to the costs incurred by the state in funding ridesharing programs. By conducting these evaluations, the RPTD is complying with the JLARC's recommendation for quantifiable assessments of program benefits, and is

providing information that ridesharing coordinators can use to improve the performance of their programs.

The analysis of the state ridesharing programs, the proposed annual evaluation, and a series of findings and recommendations for the RPTD to follow in subsequent rideshare surveys are contained in the Virginia Ridesharing Program Evaluation report prepared by JHK in 1984.

Essential factors in these benefit/cost equations are average life basis statistics for both carpools and vanpools. These are, in the case of carpools, the average length of time an individual remains in a carpool with at least one of his original pool-mates, and for vanpools, the average longevity of a vanpool arrangement. The distinction drawn here between poolers for carpools and the actual pool for vanpools is an important one. Carpools tend to be less stable organizationally and more informal. Vanpools are generally more stable because they involve the purchase or lease of a van by a person or group, a relatively fixed fare structure and schedule, and a higher degree of commitment from participants.

Currently, the average life bases used by the Department in the benefit/cost equations are 2.25 years for carpools and 4.0 years for vanpools. The former statistic was derived from assessments done by Crain and Associates for the Los Angeles Commuter Computer program in the late 1970s while the latter figure was based upon an average van amortization period of four years. (In a similar analysis for Seattle, Washington, the average carpooler life value was determined to be 2.7 years.) These statistics are used in the following equations.

$$\text{Carpool B/C} = \frac{(\$ \text{ Benefits/Carpooler-year}) \times 2.25 \text{ years} \times (\text{No. of Carpoolers})}{\text{Annual Program Costs}}. \quad (1)$$

$$\text{Van pool B/C} = \frac{(\$ \text{ Benefit/Vanpooler-year}) \times 4 \text{ years} \times (\text{No. of Vanpoolers})}{\text{Vanpool Program Costs}}. \quad (2)$$

The results of these equations are then combined in a third equation to determine the composite cost-effectiveness as shown below:

$$\frac{\text{Total Program Cost (Carpool+Vanpool)}}{\text{Effectiveness (Vanpool)+Effectiveness (Carpool)}} = \text{Composite Cost Effectiveness}. \quad (3)$$

The JHK final report recommended that the Department determine average life bases for ridesharing in Virginia to increase the accuracy of these calculations. In light of the extensiveness of these surveys and the importance of the benefit/cost calculations, it is prudent to have reliable average life data that truly reflect what is occurring in this state.

The original intent of this research effort, then, was to determine the average individual's length of participation in a carpool and the average longevity of vanpools based upon Virginia data. These figures would provide geographically accurate information for the annual evaluations, and could also be used by individual ridesharing agencies in the state as a basis of comparison with locally collected information and to make assessments of their own programs.

In addition, there was a need for accurate average fuel consumption data (MPG) for commuter vehicles used in Virginia. These data would provide detail beyond the national fleet averages and could be used in determining the gasoline savings resulting from ridesharing programs or in evaluating the fuel efficiency of commuter vehicles in Virginia in comparison with national average data.

RESEARCH METHODOLOGY

The methodology followed in developing the statistics began with a search of pertinent literature to determine if other states or ridesharing agencies had undertaken similar longevity analyses. The intent was to ascertain if other ridesharing programs have experienced average life values comparable to those calculated for the Commuter Computer program in Los Angeles or if those values were unique to one locale. Although a considerable body of knowledge concerning ridesharing has been developed over the past decade, little has been published that deals with carpool or vanpool average life values, beyond the Crain and Associates' work in California and Washington State, and its subsequent adaptations for the FHWA and the VDH&T.

Based upon the work of Crain and Associates it was learned early on in the study that a single year survey of carpools or vanpools would not provide the needed average life values. Multiyear data are necessary for computing the statistics since it would not be sufficient simply to survey current poolers. This is, in fact, what JHK implied in the program evaluation report to the Department with the statement that these statistics could not be derived from their proposed evaluation survey process (since it looked at only potential poolers from a discrete, 12-month period). It would be necessary to have input from both current and former poolers. Surveying only current poolers to determine average

life values would be analogous to measuring average human life expectancy by looking at the age distribution of all living people without considering the age distribution of any deceased -- a totally falacious approach.

Two alternative methodologies for this study were outlined in the working plan. The first was premised upon the existence and availability of some pooler longevity data from at least several of the RSAs and the ability to use both the 1983 and 1984 car- and vanpool survey data that had been collected for the two initial annual evaluations. These data would have then been used to calculate the average life values. However, after investigating this approach, it was apparent that virtually none of the ridesharing agencies possessed this type of information, that 1983 data were no longer sufficiently complete to comprise a full data set, and that accurate average life values could not be generated from only two years of data. The last point was a significant concern since the available data were limited to only those match list applicants during two 12-month periods prior to June 1984 (July 1982 to June 1983 and July 1983 to June 1984). A longer time period would need to be studied in order to develop a true average figure or at least to be certain that an average of less than two years' duration was indeed accurate.

Because of insufficient historical data and the desire on the part of the RPTD that a dynamically responsive, multiyear procedure be explored, the second methodology suggested in the working plan was pursued. Succinctly stated, what was proposed was a survey methodology to be carried out by the RPTD that would provide it with the necessary background data to calculate the statistics after a multiyear data collection process has been completed. A procedure for computing the average life values for both carpoolers and vanpools is, therefore, included.

CARPOOLER AVERAGE LIFE VALUE

There are two general steps basic to the computation of a statistically valid average life value for Virginia. These are

1. to conduct an ongoing survey of carpoolers to collect the necessary data base, and

2. to compute an average life value using the total sample population of carpoolers and a cumulative total of carpooler years as the base data.

The Survey

Since the existing evaluation survey does not provide the information necessary for calculating average life values, additional survey work is required to develop a reliable data base of people who have carpooled over an extended period of time. To compute this statistic it is needful to have repeated contact with a single group of carpoolers over a multiyear period. As the RPTD is already committed to the evaluation survey for which it has established procedures and supplementary staff, it appears most expeditious to make the proposed survey an addendum to and compatible with the ongoing annual survey. Rideshare applicants contacted for the evaluation survey form an ideal source for these data, because they make up a readily accessible, statistically drawn sample group from which a list of carpoolers can be developed.

It is, therefore, recommended that the data collection phase of this study be comprised of annual surveys of persons originally contacted through the evaluation survey who joined carpools during a single fiscal year. This group of ridesharers would be tracked over several consecutive years by annual telephone interviews to trace their ridesharing status. Those who remain in their original pools at the time of each survey would form the list of individuals to be contacted the subsequent year. The continuing survey procedure would ascertain the number of individuals who remain in their original pools and the cumulative number of years they participate.

The first year for which there is a complete record of match list applicants who joined carpools, and of those who subsequently dropped out of those pools during their initial year, is 1984. It is, then, further recommended that the base year group of poolers be drawn from the 1984 data. The names of these individuals and their ridesharing status are available in either the RPTD files or those of the Washington Council of Governments for the rideshare programs under its purview.

The proposed methodology is to track the group of poolers surveyed in 1984 to determine the longevity of the carpooling memberships. To illustrate, in 1984 it was learned that of the total number of individuals contacted, 447 people had joined carpools during the preceding 12 months with others on their match lists. However, by June of 1984 only 347 of them remained in those pools. In other words, 100 people dropped out of their carpools during the first year. These 347 remaining poolers should then be resurveyed in 1985 to ascertain their ridesharing status after two years. Those who remain would again be contacted in June of 1986, and so on for the duration of the study.

It is also recommended that the survey be repeated annually over at least a five-year period, as was done in Los Angeles, to ensure that a true average is ultimately obtained and to have the greatest amount of

actual rather than computed data. It can be reasonably expected that the number of poolers in this sample group will significantly diminish over the five years, as was experienced in Los Angeles.

As the evaluation program survey is substantially conducted via telephone interviews, it is recommended that this survey be conducted simultaneously with it, using the telephone survey techniques outlined by JHK in their report to the RPTD.

Figures 1, 2, and 3 contain the survey and log sheets that would be used in the annual survey. Figure 1 is the base sample list, which contains columns for the sample numbers (101, 102, 103, etc.), rideshare program name, carpooler name and telephone number, and a record of attempts to contact the individual. This would constitute the master list from which the interviewers would work in contacting the carpoolers to be surveyed. A new log should be prepared for each year's survey, listing only those people who remained in their original carpool at the time of the previous survey.

Figure 2 is the survey questionnaire, which consists essentially of only one question -- Is the individual still a member of the same carpool as during the previous year? If the response is no, then the interviewer will need to ask when during the year the person withdrew from the pool and record the month and year in which the individual dropped out of his pool. It might also be of interest at this point to ask why the person dropped out of the carpool and if they have subsequently joined another pool. This information is totally ancillary to the purposes of the survey; however, it could be useful for marketing analyses of the ride-share program.

The information gathered from the telephone interview should then be compiled on the form shown in Figure 3. This will be the master record for the data over the five-year course of the study. The form includes a column to enter the pooler sample number. Each pooler should retain the same sample number throughout the study so that, for instance, sample number 158 refers to the same person each year. Annually the results of the survey should be entered onto this record and a total number of poolers tallied in the space provided.

Figure 1

CARPOOLER
PHONE SURVEY LOG

Sample No.	Program Name	Poolers Name Address Phone No.	Year Began	Attempted Calls Date/Time				Completed (✓)
				1	2	3	4	
101	COMPOOL	J S BACH 555-1212	1984	N/A	N/A	6/24		
102								

Figure 2

CARPOOLER QUESTIONNAIRE

Hello, I'm _____ from the Virginia Highway and Transportation Research Council. If you have a minute I'd like to ask you one question.

Last June we contacted you to see if the (name of local rideshare program) had helped you find a carpool as a result of its match list program. You indicated that their matching service did help you get in a carpool.

1. Are you still carpooling with any of these people from the pool you were in last June?

   1) Yes 2) No

   If no, then when did you drop out of that particular carpool?

   Month _____ Year _____

   That's it, thank you very much. *We will be recontacting you next year to inquire again.

   *Only if they answered yes to the question.

Figure 3

AVERAGE LIFE VALUE STUDY - CARPOOLERS
POOLER DURATION RECORD

Sample No.	Program Name	Annual Survey Response Record Are you still in your original carpool (Y/N)? If no, when did you drop out (M/Y)? Survey Date					
		6/84	6/85	6/86	6/87	6/88	
Total Samples		Total Still Carpooling					
447							
	Retention Rate (%)						

Calculating an Average Life Value

The procedure for calculating an average life value, once the base data have been collected, is relatively simple and straightforward. It consists principally of relating the cumulative number of carpooler years to the total number of people who began carpooling in the base year to derive the average life statistic. In this it differs from the Crain and Associates procedure for the Los Angeles Commuter Computer, the distinction being primarily in the method of collecting the data and the type of rideshare data used. The Virginia study will examine the experiences of a single group of carpoolers over at least a five-year period to relate the cumulative experience back to the total number of poolers from the base year. In contrast, the Los Angeles study was a retrospective analysis evaluating the longevity of five individual groups of carpoolers without the ability to interrelate these disparate poolers to one base year sample group except through the use of dropout rates, attrition curves, regression analyses, and probability distributions.

Two types of data are then necessary to compute the carpooler average life value. These are

1. the total number of carpoolers who are being studied over the five-year period (in this case, the 447 people who began pooling during 1983-84), and

2. the cumulative number of pooler years that these people will have carpooled as derived from the successive annual surveys.

The average life value is then obtained by using these data in the equation

$$\text{Average Life Value or Years} = \frac{\text{Cumulative Carpooler Years}}{\text{Total No. of Carpoolers}}. \qquad (4)$$

To illustrate this procedure, the 1984 Virginia carpooler data will be used as the base year figure, and the annual carpooler retention rates from the Los Angeles study will be applied to hypothetically determine the number of poolers who might remain in their original carpools over a five-year period. The retention rate is the number of people who are still pooling in any given year, expressed as a percentage of the total number of people who began pooling that year or with a given group of poolers. Retention rates will not be required to compute the Virginia statistic once the base data have been collected. These rates were, however, needed for the Los Angeles work, since each year of the five years' of carpoolers surveyed was a unique group unto itself rather than

relating back to a single sample population. For instance, in Los Angeles, 69 people began pooling in 1977, but by the end of 1978 only 31 remained in their original carpools, so that the retention rate for the year was

$$\frac{31}{69} = 45\%.$$

It may, however, be interesting to compute retention rates for Virginia carpoolers for purposes of comparing them with the Los Angeles data (in the first year both California and Virginia had a rate of 78%).

To continue the example, the 447 people who began pooling during 1983-84 represent 100% of the sample population. The 347 people who were still pooling at the time of the June 1984 survey represent those who pooled for one year. People still pooling at the time of the June 1985 survey represent those who have pooled for two years, and so on. Using the California rates then, the number of people in carpools during the subsequent years of this hypothetical study would be as shown in Table 1.

Table 1

Hypothetical Carpooler Longevity

447 = 100% of Survey Population

Survey Year	Year No.	Retention Rate	No. of Poolers Remaining by Year
1984	1	78%	347
1985	2	45%	201
1986	3	42%	188
1987	4	37%	165
1988	5	25%	112
		Total Carpooler Years	1,013

The 1,013 figure is the cumulative number of years of carpooling represented by this five year data base. Of the total number of participants, 347 people carpooled for one year, 201 for a subsequent year, 188 a third, and so on. To compute the average life value, simply divide the

cumulative number of years by the sample population size of the people who began carpooling, as follows:

$$\frac{\text{1,013 Carpooler Years}}{\text{447 Carpoolers}} = 2.29 \text{ years.}$$

The 2.29 figure would then be used in the equation for computing the benefit/cost ratio of Virginia's ridesharing program as shown previously in equation (1).

Since relating the total number of poolers to the number of pooler years is the basis of the calculations, it is critical that the absolutely maximum number possible of the remaining sample poolers be contacted annually. The fewer people who are contacted during the survey, the potentially lower will be the average life basis, as the denominator in the equation remains constant while the numerator is the variable, dependent upon the survey findings. This is especially necessary in the early years of the study since subsequent surveys depend upon the contacts made in the preceding surveys.

Obviously, some decision rules are necessary regarding the inability to reach some individuals. In instances where a phone number is no longer in service or has been changed, it would be reasonable to assume that the person has moved, and, therefore, dropped out of his 1983-84 carpool.

If during the annual surveys a significant number of carpoolers cannot be reached after a reasonable number of attempts, then the data will have to be adjusted relative to the base year number of poolers -- e.g. the number for 1984 -- to compensate for the deficiency of responses. A loss of sample poolers in any one year will be reflected in the subsequent years of the survey, as each annual list of poolers is dependent upon the prior year survey results. For example, if of the 347 people to be contacted in June of 1985, only 310 could be reached, and 185 of these were still pooling, the survey data would have to be adjusted to compensate for the 37 fewer interviews relative to the 447 base year of poolers.

Two types of adjustments are proposed. One would be to factor the survey data upward to compensate for the fewer number of completed interviews. Using the figures cited above, the factoring process would be accomplished as follows:

$$\frac{\text{310 Surveyed Poolers}}{\text{185 Remaining Poolers}} \div \frac{\text{347 Sample Poolers}}{\text{n Remaining Poolers}} = 201 \text{ remaining poolers.}$$

By using the ratio method to factor the results, the base year total would remain unchanged while the annual survey results would be adjusted to compensate for the deficiency in the number of poolers contacted. This process is based upon the assumption that, of the individuals who could not be surveyed (in this case 37), the ratio of poolers to non-poolers would equal the pooler to nonpooler ratio of the group that was reached ($\frac{310}{185}$, or 5:3). Thus, the number of remaining carpoolers after two years theoretically should be 201 of the original 447.

The factoring procedure does have a drawback in that once the annual results have been factored in this fashion, the data for subsequent surveys will have to be factored as well; e.g., only 185 persons would remain to be contacted at the end of three years, although the computed number of continuing poolers would be 201.

The alternative, and favored, approach to adjusting for non-reachable carpoolers is to each year subtract these poolers from the base year total to reflect the fewer number of completed interviews. Such an approach would eliminate the need for assumptions regarding the actions of persons not reached in the survey. This would require annually computing a carpooler retention rate, as has been discussed earlier. Once this process of subtracting from the base year total has been done for one year, it will also have to be done for each year of the survey data prior to the year in which the deficiency occurred. To illustrate this, using the numbers from the above example, the process would be:

Base year (1984) poolers = 447

First Year Survey - 1984

447 new poolers
347 are still pooling at the end of year one

First year retention rate = $\frac{347}{447}$ = 78%

Second Year Survey - 1985

347 poolers to be contacted
310 could be reached (difference of 37)
185 of the 310 are still pooling at the end of year two
Adjusted base year = 447 - 37 = 410

Second year retention rate is $\frac{185}{410}$ = 45%

Third Year Survey - 1986

185 poolers to be contacted
170 could be reached (difference of 15)
165 of the 170 are still pooling at the end of year three
Adjusted base year = 410 - 15 = 395

$$\text{Third year retention rate} = \frac{165}{395} = 42\%$$

Fourth Year Survey - 1987

165 poolers to be contacted
150 could be reached (difference of 15)
140 of the 150 are still pooling at the end of year four
Adjusted base year = 395 - 15 = 380

$$\text{Fourth year retention rate} = \frac{140}{380} = 37\%$$

Fifth Year Survey - 1988

140 poolers to be contacted
110 could be reached (difference of 30)
85 of the 110 are still pooling at the end of year five
Adjusted base year = 380 - 30 = 350

$$\text{Fifth year retention rate} = \frac{85}{350} = 25\%$$

Computation of a Carpooler Average Life Value

Year of the Data	Base Year No. of Poolers		Retention Rate		No. of Poolers Remaining (by year)
First year	350	x	.78	=	273
Second year	350	x	.45	=	158
Third year	350	x	.42	=	147
Fourth year	350	x	.37	=	130
Fifth year	350	x	.25	=	85
Total Number of Carpooler Years					791

$$\text{Average Life Value} = \frac{\text{791 Carpooler Years}}{\text{350 Base Year No. of Poolers}} = 2.26 \text{ years}$$

Note: The number of carpooler years is expressed in whole numbers for example, however, in actual practice fractions of years should be considered to account for persons who pool six months or nine months, etc., into a fiscal year.

This exercise provides a worst case example in that there was a deficiency in the number of completed surveys for each of the five years. Such a process would smooth out inaccuracies by decreasing the base year number of poolers commensurately with the number of interviews not completed. It would then relate this adjusted base year figure to the annual retention rates to compute the total carpooler years.

At the conclusion of five years of surveys, it would not be appropriate to simply truncate the study data if there remain a significant number of people still in their original carpools (greater than 10% of the original group). As in the example, 85 individuals remained in their pools. If this is the case, then two alternatives are available for adjusting the data. The first is to extend the study indefinitely until less than 10% of the original poolers are no longer ridesharing. This could significantly delay the computation of a Virginia based average life statistic, but would provide real rather than projected survey information.

The second method, and the one recommended, is to use regression analysis to predict the number of people who will remain in their carpools in each of the subsequent years until the number reaches zero. Such an analysis can be done reliably with five years of background data, the use of a microcomputer, and a regression analysis program. Statistical programs, such as the DAISY, that are compatible with Apple

computers can be used simply and quickly, and produce year-by-year information which can then be used in the average life value equation.

The RPTD is also interested in enabling the RSAs throughout the state to develop their own program evaluations and benefit/cost assessments similar to the one it uses on a statewide basis. This will require the computation of average life values for each of the 15 RSAs. Such a task can be accomplished for most of the agencies by using the same computational procedures previously outlined. The log forms shown in Figures 1 and 3 have been provided with a column to indicate the name of the RSA the would-be pooler applied to for a match list. Thus, the data for each program can be separated from the statewide totals and individual average values can be calculated.

The principal difficulty in preparing the individual average life values for the RSAs relates to the sample size of the population being studied. For statistical reliability, a sample population should have, at a minimum, 30 contacts. While only six of the 16 rideshare programs have this many ridesharers, as shown in Table 2, those with 20 or more samples might cautiously attempt such a computation, comparing their findings closely with statewide and local program results to ensure a degree of accuracy. Especially for those programs having fewer than 20 carpoolers, it would be far more practical to use the statewide averages.

Table 2

Stratification of the Ridesharing Programs for Computing Individual Average Life Values

1984 Survey Data Programs	Match-List Applicants	Applicants in Pools	Formation Rate
Alexandria	1,324	55	20.5%
MWCOG	4,908	81	24.7%
Prince William Co.	2,153	124	35.2%
Fairfax Co.	5,639	57	17.6%
Northern Virginia Subtotal	14,024	317	23.1%
COMPOOL	2,734	35	10.6%
Peninsula TDC	670	7*	4.3%
JAUNT	674	22	10.8%
Middle Peninsula TDC	43	2*	7.0%
RADCO PDC	1,163	13*	6.2%
R R PDC	49	4*	12.2%
Greater Roanoke Transit	374	22	8.3%
James City Co.	31	2*	6.5%
Tidewater TDC	205	3*	3.4%
Lord Fairfax PDC	197	20	20.3%
Statewide Totals	20,164	417	18.8%

*Rideshare programs for which individual average life value statistics should not be computed due to excessively small sample population sizes.

VANPOOL AVERAGE LIFE VALUE

The development of an average life value for vanpools should follow a procedure essentially the same as that recommended for the carpool average value. This consists of the same two steps of (1) multiyear telephone surveys of vanpool drivers, and (2) a computation of the average life statistic based upon the survey data. The survey or sample group will be drawn from the list of vanpool drivers created from the annual evaluation surveys. The differences in survey methodologies between carpoolers and vanpool drivers results from the need to study the longevity of the vanpool arrangement itself as opposed to the tenure of the individual carpooler in a carpool. The reasons for this distinction have already been set forth in this report.

The recommended procedure for the vanpool survey is to select from the evaluation survey results the pools that have been formed during one fiscal year, and to track these pools via repeated annual contacts with their drivers to ascertain how many years each of the pools remains in operation. As with carpoolers, 1984 is the first year for which there is a complete list of vanpools formed through the assistance of the RSAs. These data would then constitute the base year data. As vanpools tend to remain in existence longer than carpools, due ostensibly to a greater degree of effort and commitment required for their formation, this survey should be continued longer than the five years suggested for carpoolers. For instance, a minimum of seven years should be considered. In 1984, 45 new vanpools were formed statewide through the efforts of the RSAs. As this sample size is considerably smaller than that of the carpoolers, the survey should not be overly time consuming or burdensome for the RPTD.

The basic recording forms needed for the vanpool surveys are shown in Figures 4, 5, and 6. The first, Figure 4, is a vanpool driver telephone survey log that includes sample number, the rideshare program that assisted in formation of the pool, vanpool driver's name and telephone number, the year the pool began, and a record of attempted and completed contacts. A new log should be prepared for each annual survey. Due to the small sample size, it is imperative that the interviewers make every reasonable attempt to contact all of the listed drivers.

The second vanpool survey form, in Figure 5, is the driver questionnaire on which the interviewer records driver responses. The driver is asked if the pool is still in existence, and if not, when it was disbanded. Because a vanpool is more apt to have a change in drivers than it is to disband, space is provided to record a new driver's name, address, and telephone number if a change has occurred. This information would then be used to update the driver survey log for the following year.

The third form is a record of the total data collected over the several years of the vanpool survey. As shown in Figure 6, it includes columns to record the sample number of each driver, the rideshare program, and the annual response information from each vanpool. At the bottom of the form is space to total the number of vans operating in each year of the survey and to list the annual retention rate.

Figure 4

VANPOOL DRIVERS
PHONE SURVEY LOG

Sample No.	Program Name	Driver's Name Phone Number	Year Began	Attempted Calls Date/Time				Completed (✓)
				1	2	3	4	
101	COMPOOL	Ralph Cramdon 555-1212	1984	N/A	6/3			
102	COMPOOL	MA BELL -						
103								

Figure 5

VANPOOL DRIVERS
DURATION QUESTIONNAIRE

Hello, I am _____ from the Virginia Department of Highways and Transportation. If you have a minute, I would like to ask you a couple of questions. This is part of our ongoing vanpool evaluation study.

Last June we contacted you to see if (name of local ridesharing program) had helped you organize a vanpool. You indicated that they had been of assistance and that a pool had been formed of which you were the driver.

1) Is that pool still in operation?

1. Yes 2. No

1a) If no, when did the vanpool disband?

Month _____ Year_____

2) Are you still the driver of the vanpool?

1. Yes 2. No

2a) If no, could you refer us to the current driver of the pool or to another participant in the pool if you are no longer involved with it.

Name : _____

Address: _____

_____

Phone : _____

Thank you very much for your help. We will be recontacting you next year to inquire again as to the status of the pool.

(Data from this sheet are to be entered on the log sheet and Pool Duration Record form.)

Figure 6

AVERAGE LIFE VALUE STUDY - VAN POOLS
POOL DURATION RECORD

Sample No.	Program Name	ANNUAL SURVEY RESPONSE RECORD Pool Still in Operation (Y/N), If No, When did it Disband (M/Y)? Survey Date						
		6/84	6/85	6/86	6/87	6/88	6/89	6/90
Total Samples		Total Pooling						
	Retention Rate							

Two additional recommendations need to be made regarding the vanpool survey. These are:

1. If from the results of the 1985 vanpool driver survey there appears to have been a significant increase in the number of vanpools formed during the preceding 12 months (60 or more versus the 45 from 1984) than from the 1984 survey, then 1985 should be made the base year.

2. If at the end of at least seven years there is not a significant reduction in the number of vanpools, then a regression analysis should be made using the data collected to date to predict the number of vanpools that will remain in each of the successive years until all of the base year pools have been disbanded. This will allow the RPTD to compute an average life value without waiting indefinitely for the needed statistics.

Computing the average life value for pools will parallel the procedure recommended for the carpooler average. The same general equation given as number (4) should be used:

$$\text{Average Life Value Vanpools or Years} = \frac{\text{Cumulative Vanpool Years}}{\text{Total No. of vanpools}}. \qquad (5)$$

The total number of vanpools in the denominator includes those that commenced operation in the base year of the study -- e.g, 45 if 1984 is used -- and the cumulative vanpool years in the numerator is the total number of years all of those 45 vanpools continue in existence. As with the carpooler survey, if a significant number of vanpool drivers cannot be reached after reasonably persistent attempts to contact them, then the survey results will need to be adjusted upward to compensate for an incomplete survey. As the sample size for vanpools is relatively small, great caution should be exercised in using either the factoring process or the base year reduction methodology suggested for the carpoolers survey. Again, it should be emphasized that due to the relatively small sample size, it is imperative that as many drivers as possible be contacted .

Since an average life value for vanpools has not been previously calculated, as was available for carpoolers, there is not a benchmark or standard from which to judge the relative accuracy of the results of this survey and computation. However, with careful and persistent survey work to develop the data base, the resultant average value should reflect the actual experience of Virginia's vanpools. Because the statewide vanpool sample size is relatively small, it would not be advisable to attempt the

computation of individual average life values for local ridesharing agencies.

RIDESHARING VEHICLE FUEL ECONOMY

The third data item of interest to the RPTD and not currently available is an average fuel consumption or miles per gallon (MPG) figure for ridesharing vehicles in Virginia. A significant body of data on vehicle MPG has appeared in transportation and energy conservation literature since the beginning of the gasoline shortages in the early 1970s. However, based upon the literature search undertaken for this study, there was not found any study published to date that specifically considered MPG for commuter vehicles either nationally or for individual states or localities.

To compute this statistic, it is recommended that the base data be derived in the annual carpool evaluation survey by the interviewer asking those applicants who have formed or joined a carpool the MPG of the pool vehicle. A sample question is shown in Figure 7. This question should become part of each annual survey so that the Virginia MPG data can be updated annually and be kept current with the changing vehicle fleet mix.

Since several vehicles are generally used in rotation by the participants of a carpool, the question should be directed toward the vehicle that the person being interviewed contributes to the pool. In some instances only one vehicle is used by a carpool, while in others some members contribute in ways other than through use of their vehicles. When this is the case these poolers should be asked the MPG of the vehicle principally used by the carpool. In either case, the most desired fuel consumption figure is that actually being experienced from operation of the vehicle under consideration. As a rule, people are notoriously uninformed as to the MPG of their own vehicles let alone that of another person's. If this figure is not known by the carpooler, then the interviewer should inquire as to the make, model, and year of the vehicle used by the carpool as indicated in the sample question. In this case, an estimated MPG can then be obtained from the Environmental Protection Agency's (EPA) fuel economy figures published annually.

Since even with vehicles of the same make, model, and year mileage estimates can vary due to size and type of engine, type of transmission, optional equipment, and a multitude of other factors, some decision rules are necessary. In light of the intended use of these data, it is best to take the most conservative mileage estimate so as not to overstate any claims of benefit which could later be brought under question.

Figure 7

SAMPLE INTERVIEW QUESTION

14. What is the average miles per gallon for the vehicle you contribute in the carpool? _____ mpg

Notes: If you don't drive, what is the average mpg of the vehicle principally used in your carpool? _____ mpg

If you don't know this figure, what is the make, model and year of the vehicle? (Yours or the one principally used.)

Make : _____

Model: _____

Year : _____

Therefore, when looking up the MPG estimates for these vehicles, the more conservative figure (generally the city driving estimate) should be used for a particular make, model, and year.

Correlating the EPA estimates for each carpool vehicle could become a cumbersome, time-consuming process. In the future, a simple computer program could be developed to alleviate manually referencing the average MPG for each vehicle. By coding in the EPA estimated averages, survey data could be entered into the computer and the program would then correlate vehicle type with estimated MPG, sum this information for all of the samples, and calculate a commuter fleet average. Each year, as new EPA estimates are published, the program would have to be updated, but could, overall, make the averaging process less time consuming and simpler.

An average MPG figure can then be computed from these data either manually or by using a computer program. This average should be re-computed each year based upon new information obtained from the annual evaluation survey and new MPG figures from the EPA by dividing the sum of the individual MPG figures by the total number of vehicles sampled as in the following formula:

$$\text{State Average Commuter Vehicle MPG} = \frac{\text{Cumulative Sum MPG of All Sampled Vehicles}}{\text{No. of Vehicles in the Sample}} \qquad (6)$$

CONCLUSION

The development of accurate Virginia based average life values for carpools and vanpools is of considerable importance for an evaluation of state sponsored ridesharing programs. The methodology for developing the necessary data base and computing the needed statistics was premised upon making the procedure as compatible as possible with the annual evaluation survey process.

The procedure outlined for data acquisition should, especially after 1985, require a minimum of additional labor, and make the equations to compute the average life values simple to use. The MPG assessment should be equally simple, especially if the EPA statistics are used.

Finally, it is recommended that these average life value statistics be recomputed periodically as long as the Department continues to make the annual program evaluations. A reassessment based upon a multiyear data base should be made every five to ten years to assure that the average life values have not changed with shifting social or economic trends or the maturing of the ridesharing programs.

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REFERENCES

1. Glazer, L., et al., Commuter Information System. Crain and Associates Systems Development Company and the Federal Highway Administration, Washington, D.C., May 1976.

2. _____. Carpool Program Evaluation. Prepared by Crain and Associates for the Computer Carpool and Vanpool Ridesharing Program of the city of Los Angeles, California, May 1979.

3. JHK and Associates, Virginia Ridesharing Program Evaluation. Prepared for the Virginia Department of Highways and Transportation, Alexandria, Virginia, January 1984.

4. Office of Highway Planning, Highway Statistics Division, Cost of Owning and Operating Automobiles and Vans 1984. U.S. Department of Transportation, 1984.